ANACONDA Aluminum Company **Internal Correspondence**

Date: May 24, 1983

Subject: Primary Metals R & D May Monthly Report

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R & D PROJECTS

High Purity Alumina

The patent on the high purity alumina process has been reworked and resubmitted to Jim McClain.

The eight-experiment, two-level factoral design study of the properties of alumina prepared by the ARCO process is complete. Results of SEM and particle size work should be received within two weeks. The results have not been rigorously analyzed but the following general observations can be made:

	Density		Linear Shrinkage
	Green	Fired (1500°C, 4 hrs)	
RC-HP	2.13 g/cc	3.95 g/cc	19.4
ARCO	2.17	3.90	18.7

Jerry Davis has pointed out that it is in general very difficult to achieve good ceramic properties in small laboratory grinding mills. At this stage we have not optimized calcining conditions, grinding or firing temperatures. We still have found nothing that would indicate that we cannot achieve good ceramic properties.

In order to identify the variation of alumina phases with temperature during calcination, material was calcined in a rotary kiln at temperatures between 800 and 1150°C. The presence of transition phases of alumina other than gamma and alpha, could not be determined since the XRD laboratory does not have standards. The phase path during calcination will bear on ceramic properties so a means of identifying other phases will be developed.

Heat and material balances from the METSIM run have been completed. Sizing and preliminary specifications have been determined for the leach vessel, ACH slurry cooling unit, solid liquid separation, ACH decomposer and calciner. Other items will be specified within a week. We have identified suppliers for grinding and calcining equipment.

AD-120 Process

A. Ore to PCACH - Water testing and debugging of the gas sparging crystallizer has been completed and the statistical test program to determine optimum operating conditions has been started. During the

start-up phase of operation samples were taken to determine the crystal size distribution. At a very high unit production rate, 14.5 lb/hr ft^3, the crystal size analysis showed 72 percent of the crystal were minus 100 mesh. The objective is to obtain greater than 80 percent of the crystals +100 mesh. Initial experimentation is operating at a production rate of 10 lb/hr ft^3. Approximately two days are required to reach equilibrium in the system so the experimental plan may be shortened to save time.

The AFC has been approved for the bleed stream pilot plant. All major equipment has been ordered and should be received in 8 to 10 weeks. A temporary technician has been hired to clean up the site and start preparations for equipment installation.

Construction of the ACH fluid bed calciner is underway. The HCl scrubber unit is in place and installation of the calciner and the feed and discharge systems is in progress.

B. Chlorination - Chlorination studies have been segregated and are being conducted in the categories of 1) High Pressure Fluid Bed (HPFB), 2) CxCly Formation Mechanism, 3) Alumina Chlorination Mechanism with Intermediates, and 4) Intermediate Formation.

1. HPFB - The zone controlled, quartz window furnace that can accept one or two inch beds has arrived. It is being installed and should be operational by month end. A cyclone is under construction and will be installed with the HPFB in the new furnace.

2. CxCly Formation Mechanism - The downflow reactor investigations showed a possible relationship between the addition of O_2 and a reduction in DCB which will be further pursued in the upflow fluidized bed reactor.

   In the upflow reactor, a particle size relationship with PCACH and coke has been established to prevent bed segregation during runs that consume over 99 percent of the bed. Chlorination runs have been made using various cokes at stoichiometry and coke in excess of stoichiometry. Although not yet fully analyzed, experimental results indicate a relationship between coke type, pretreatment, amount of CxCly and stoichiometry of coke in the bed. It appears possible to produce $AlCl_3$ with less than 3-5 ppm PCB and approximately 500 ppm lighter CxCly compounds.

3. Alumina Chlorination Mechanisms with Intermediates - CCl_4 can be utilized to produce $AlCl_3$ at 450°C with 2-10 ppm low molecular weight CxCly (HCE), 0-5 ppm intermediate CxCly (hexachlorobenzene, HCB), and 0-2 ppm high molecular weight CxCly which are true PCB's (decachlorabyphenyl, DCB).

4. Instrumentation - The Carl GC's are now operational and are being used to perform off-gas analysis on chlorination experiments.

The IR machine has been received and is being set up for HCl off gas analysis as well as identification of other compounds in the chlorination studies.

A cooling mode is being installed on the HP 5880 for more rapid and accurate analysis of the low molecular weight CxCly compounds.

ASV Magnetics

Buswork modifications on Pots 516, 517, and 518 have been completed. Pot 518 was taken out of service because of potential cathode failure but will be restarted by month end. Pots 516 and 517 are running smoothly with metal pads approaching fifteen inches. The five-pot test string will be completed by mid-June. Costs are within plan and charges against the Tucson account should be completed by the end of June.

Lithium Bath at Columbia Falls

Test pots averaged 2.6 percent lithium in the bath for the month of April. The bath temperature averaged 960°C which was 5°C lower than the previous month. Consumption of lithium carbonate is gradually falling as expected and other operating parameters are approaching levels which will demonstrate improvements in efficiency and unit energy consumption.

Anode Optimization

Approximately half the scheduled bakes have been made on the Columbia Falls Phase II testing. Composites using the reported Mitsubishi recipe were prepared and will be measured for comparison by month end.

TECHNICAL SUPPORT/SERVICES

Anode Operations at Columbia Falls

The anode dusting problem at Columbia Falls has improved substantially. The improvement is attributed to the lower real density ARCO coke which reached the surface of the anode within the same time period that the dust began to subside. The change to the lower real density ARCO coke was implemented as per Sam Jones' recommendations addressing the anode problems at Columbia Falls. Meanwhile, Collier coke is being used exclusively and will reach the anode surface in August.

Sebree Line 4 Cell Technology Selection

The technology selection team has completed its investigation and Subodh Das will be reporting recommendations in a formal report to be issued by the end of May. The recommended technology will be basically the P-155 with the ability to accommodate innovations such as ECL cranes and large anodes.

Raw Material Quality Control Review

Sam Jones completed a study of raw material quality control at Sebree and recommended modification of sampling procedures and the addition of some analytical measurements particularly in the area of alumina control.

Raw Materials Strategic Planning Committee

A meeting to revitalize this committee is now scheduled for July 12 in Chicago.

Anode Consumption Cell

Two runs on the anode consumption cell were completed this month before failure of three furnace heating elements. Cause of the failure appears to be the corrosion of stainless steel welds used on the inconel shell leading to similar failure of the element wire. The shell in salvageable and inconel welding rods have been ordered for the shop. Elements also have been ordered. Within the next 2 to 3 weeks the cell should be in working order.

Anode consumption cell operating procedures are currently being written and will be issued by month end.

Use of Control Charts for the Green Mill Operation at Sebree

Paul Russell has written a proposal to implement control charts to better monitor the green mill process at Sebree. The control charts should improve utilization of existing data collected, providing better feedback for process control.

Back EMF Control Logic

We have developed a series of graphs which show the interrelationships that key variables have on the back emf. Alumina concentration, current and temperature are the major factors which affect the back emf. We continue to work with Sebree in an effort to fully address this issue before the conversion to large anodes in September.

Anode Committee Meeting

Plans are being made to have an anode committee meeting at Harvey Tech Center in late June.

FACILITIES

Laboratory Carbon Screening

An investigation is in progress to locate some screening equipment that will improve the productivity of our carbon sizing activities in the laboratory. We are currently having to use an inordinate amount of technician time in this area. If we can find alternative equipment that can be economically justified,

we will prepare an AFC for its purchase. ATM Sonic Sifter Company has agreed to run samples of our coke to determine expected productivity of their equipment.

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